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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/667,504

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Peter Larsson

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EXAMINER

VARTANIAN, HARRY

ART UNIT

PAPER NUMBER

2634

9

DATE MAILED: 05/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/667,504

Applicant(s)

LARSSON, PETER

Examiner

Harry Vartanian

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3,6,8,9 and 12-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,6,8,9 and 12-27 is/are rejected.
- 7) ☒ Claim(s) 3 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 September 2000 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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Detailed Action

1. Claims 1-3, 6, 8-9, and 12-27 are pending in this case.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. Claims 1, 2, 6, 9, 12-17, 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace et al(US Patent #6473467). Regarding Claims 1, Wallace et al meets the following limitations:

feeding the signal to a plurality of antenna paths, wherein the signal includes a number of positions, each of the number of positions including a sample; **fig 1A; (Column 4, Lines 48-63)**

receiving the signal in each of the plurality of antenna path paths; **fig 6**

for each antenna path, shifting the samples of the signal a predetermined direction and number of positions, wherein the predetermined direction and/or number of positions are different for at least two of the antenna paths, said shifting step including: **Note: In (Column 20, Lines 64 to column 21, line 5) it is stated that cyclic prefix generator produces a prefix for a SPECIFIC antenna. This is supported in fig 3. Therefor the prefixes are different for each antenna path. Also see (Column 26, Lines 1-6).**

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when shifting samples toward the beginning of the signal, shifting samples that are shifted beyond the number of positions in the signal into a corresponding number of positions at the end of the signal; **(Column 26, Lines 1-6)**

in each antenna path, including a number of samples from the beginning or the end of the signal in a cyclic prefix; and **(Column 26, Lines 1-6)**

transmitting the signal and the cyclic prefix from each of the plurality of antenna paths. **Fig 3**

Wallace et al fails to meet the limitation:

when shifting samples toward the end of the signal, shifting samples that are shifted beyond the number of positions in the signal into a corresponding number of positions at a beginning of the signal;

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to create the cyclic prefix by shifting information from the end of signal to the beginning, since it has been held that a mere reversal of the essential working parts of a device involves only routine skill in the art. in re Einstein, 8 USPQ 167. The effect of wrapping data from the beginning or end of the frame has essentially the same effect, which to reduce the cross correlation among multiple antenna paths.

Regarding Claim 2, Wallace et al meets the following limitations:

wherein the predetermined number of positions corresponds to a position of the antenna path with respect to the number of antenna paths. **(Column 20, Lines 64 to column 21, line 5)**

Moreover, since he discloses that each specific antenna has its own cyclic prefix generator, it is implied that each position or path will have a predetermined number of position.

Regarding Claim 6, Wallace et al meets the following limitations:

wherein the signal is an orthogonal frequency division multiplexed symbol**(Column 26, Lines 1-6)**

Regarding Claim 9, Wallace also discloses the use of inverse fast Fourier transform in his transmitter(Fig 1a). Moreover, Wallace discloses the use of a full channel state information

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(CSI) that sends "sufficient characterization of the propagation path (i.e., amplitude and phase)" of the transmission path to the transmitter to perform gain control at the transmitter (Column 8, Lines 53-63).

Regarding Claims 12-16, the rejection of the Claims above meet scope of the Claims. More specifically, the applicant recites using different cyclic shifts, forward or reverse, for each antenna path to ensure that the cyclic prefixes for each are different. This limitation is met by Wallace et al by showing that each antenna path has it's own cyclic prefix generator.

Regarding Claim 17, Wallace et al meets the following limitations:

means for applying an error correction code to signal; and an interleaver. **DETX para 91**

Regarding Claims 22-23, the rejection for Claim 1 above applies here.

Regarding Claims 24, Wallace et al meets the following limitations:

wherein the transmitter further includes means for performing an inverse fast Fourier transform(**fig 1b item 142**); and

means for adding a prefix to the signal in each antenna path(**fig 1b item 143**);

the receiver further includes means for removing the prefix; (**Column 28, Lines 41-57**)

means for performing a fast Fourier transform. (**fig 1b item 147**);

Regarding Claims 27, the rejection for Claim 1 above applies here.

2. Claims 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace et al(US Patent #6473467) in view of Kumar(US Patent #6005894). Wallace et al meets all the limitations of Claims 18-20(see above paragraphs) except disclosing the use of guard intervals composed of samples from the end of the signal in his transmitter diversity scheme.

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However, Kumar states that "OFDM systems also commonly incorporate an extension of the symbol interval by a further amount of time known as the guard interval...which is typically generated by appending a null(zero) signal or a partial cyclic extension of the previous symbol, but its existence provides a period of time in which deleterious intersymbol interference may occur without disrupting the operation of the receiver." (Column 26, Lines 57-65) Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that Wallace et al's communication system use guard intervals at the end or beginning of a symbol, as disclosed by Kumar. The motivation to combine these technologies is that a guard interval is commonly used in packet data communication systems to combat intersymbol inference.

3. Claims 21 and 26 rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace et al (US Patent #6473467) in view of RIAZI et al (US Patent #6580705). Wallace et al meets all the limitations of Claim 21 and 26 (see above paragraphs) including the use of multiple antenna paths in the receiver, which Wallace discloses in fig 1a, except disclosing the use of maximal ratio combining in his receiver.

However, Riazi et al disclose a OFDM system that uses MRC. (See Abstract) Therefore it would have been prima facie obvious to use MRC in an OFDM system. The motivation to combine is that it is well known in the art at the time of the invention that maximum ratio combining can improve signal detection in a multipath environment by choosing the copy of the signal that comes in the strongest.

4. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace et al (US Patent #6473467) in view of O'Sullivan et al (US Patent # 5487069). Wallace et al

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meets all the limitations of Claims 8 (see above paragraphs) except disclosing the use of interleavers to lower the correlation among the carriers of each antenna path for error protection.

However, O'Sullivan states that:

"As referred to above, link data interleaving schemes can be used, in this system, to further improve the error correcting performance of **FEC codes** which distribute the contribution of individual data elements over fewer carriers than the total number in the ensemble. Link data ***interleaving schemes do this by distributing the encoded data between the carriers in such a way that the correlation in error probability of those carriers associated with any given element of uncoded input data is minimised.*** On average, this corresponds to maximising the minimum frequency spacing between those carriers. **DETX (42)**

Therefor it would have been prima facie obvious to interleaver carriers in order for them to be uncorrelated when later de-interleaved in the receiver. The motivation to combine is stated by O'Sullivan wherein he implies in the paragraph above that interleaving can improve FEC code performance.

5. Claims 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wallace et al(US Patent #6473467) in view of RIAZI et al (US Patent #6580705) further in view of O'Sullivan et al(US Patent # 5487069). Wallace et al and Riazi et al met all the limitations of Claims 25 (see above paragraphs) except disclosing the use of interleavers to lower the correlation among the carriers of each antenna path for error protection.

However, O'Sullivan states that:

"As referred to above, link data interleaving schemes can be used, in this system, to further improve the error correcting performance of **FEC codes** which distribute the contribution of individual data elements over fewer carriers than the total number in the ensemble. Link data ***interleaving schemes do this by distributing the encoded data between the carriers in such a way that the correlation in error probability of those carriers associated with any given element of uncoded input data is minimised.*** On average, this corresponds to maximising the minimum frequency spacing between those carriers." **DETX (42)**

Therefor it would have been prima facie obvious to interleaver carriers in order for them to be uncorrelated when later de-interleaved in the receiver. The motivation to combine is

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stated by O'Sullivan wherein he implies in the paragraph above that interleaving can improve FEC code performance which can be helpful in an OFDM system.

Allowable Subject Matter

1. Claim 3 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry Vartanian whose telephone number is 703.305.8698. The examiner can normally be reached on 9-5:30 Mondays to Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on 703.305.4714. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Harry Vartanian
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HV


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